The PERLITE Torch

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THE INTERNATIONAL TRADE ASSOCIATION
OF PERLITE MINERS AND EXPANDERS

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Please pass this on

Perlite Concrete Chosen to Insulate World's Largest Sub-Zero Warehouse

More than 275,000 cu ft of lightweight Perlite concrete were used to insulate the floor and roof deck of the world's largest sub-zero storage warehouse recently completed for Continental Freezers of Illinois, Inc. in Chicago.

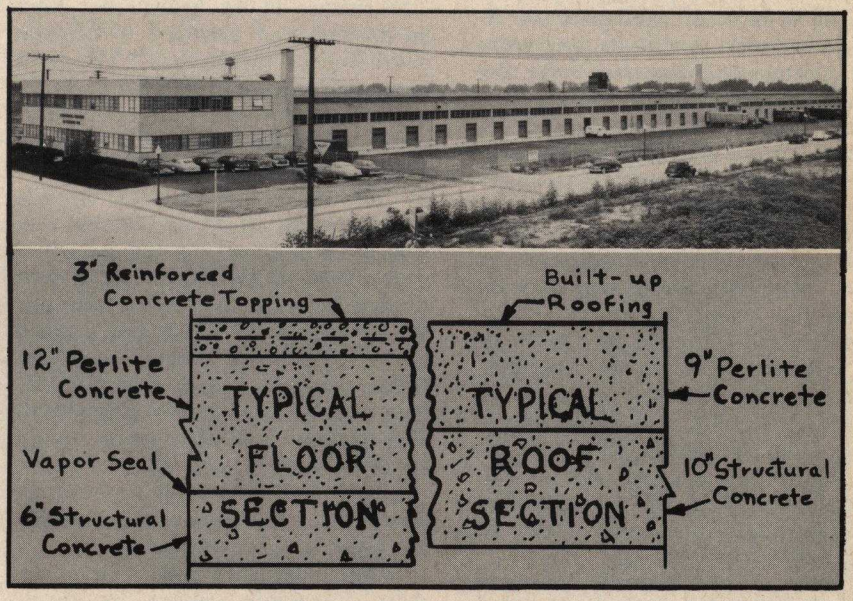
Record-breaking summer heat waves have already given the new insulation a severe test. While Chicago sweltered in 95° heat, temperatures inside the plant hugged the –20°F mark — a differential of 115° between the inner and outer surfaces of the Perlite concrete!

The huge new cold storage plant embodies the latest new ideas in design and equipment. Housed in a 1,000 ft by 191 ft reinforced concrete building with brick enclosing walls, its four huge freezer rooms provide a combined storage space of 2,756,000 cu ft at temperatures from –10°F to –20°F.

To sustain these frigid temperatures over such a large area, Perlite insulating concrete was a natural selection. Its light weight was especially important since the entire plant, with the exception of engine room and loading docks, is erected on pillars 4 ft above grade to provide a ventilated space below the floor. This construction prevents structural movement due to the freezing and buckling of the ground which might occur if a grade level floor slab were used.

Insulation for all freezing room floors is provided by a 12-in. thickness of Perlite concrete. This insulating layer was poured over a vapor seal applied to a sub-floor of standard 6-in. structural concrete. To carry the heavy warehouse traffic, a 3-in. reinforced concrete working floor was poured on top of the Perlite concrete. (See diagram above).

(Continued on Page 4)



New Plaster Conductivity Data

The excellent insulating qualities of Perlite-gypsum plaster have been confirmed by new thermal conductivity data determined by a nationally recognized research foundation.[1]

Tests by this impartial laboratory show that Perlite-gypsum plaster provides from 6 to 7 times the insulation of standard gypsum plaster of the same thickness. In terms of dollars and cents, this extra insulation value can mean substantial savings in heating and air conditioning costs as well as light weight and fire protection for buildings plastered with Perlite-gypsum plaster.

THERMAL CONDUCTIVITY OF PERLITE-GYPSUM PLASTER

Composition	Density lb/cu ft	Thermal Conductivity "k"[2]
2 cu ft of Perlite aggregate to 100 lb of fibered gypsum	46.9	0.857
3 cu ft of Perlite aggregate to 100 lb of fibered gypsum	38.5	0.800
Scratch coat (2cf:100 lb), brown coat (3 cf:100 lb) and standard finish coat on ½ in. gypsum lath	44.6	0.813

[1]Name on request [2]Btu/hr/sq ft/°F/in. thickness at 75°F

A.I.A. file No. 21A5 and 21C1

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PLASTER CRACKS – Their Causes and Prevention

Part III of a 4-Part Series

Proper Basecoat Proportions

The Perlite Institute recommends full compliance with American Standards Specification for Gypsum Plaster as given in ASA A42.1. Briefly, this specification calls for not more than 2 cubic feet of aggregate in the scratch coat, and not more than 3 cubic feet in the brown coat, to 100 pounds of neat gypsum plaster for application on metal and gypsum lath. For two-coat (double-up) work the mix proportion of 2½ cu ft: 100 lbs gypsum may be used for both coats. These recommendations should not be exceeded except in the case of high suction bases where ASA A42.1 permits a proportion of 4 cu ft of aggregate/100 lb gypsum plaster. Architects, engineers and plaster manufacturers have for many years specified the same volumetric proportions for sand and the records show that in most cases where failures have occurred, the proportion of aggregate used was higher than specified.

Over high suction bases such as brick, clay tile, cinder and gypsum block, the higher proportion of aggregate noted above can be used without adversely affecting the hardness. This is because the high suction base immediately pulls most of the excess water from the mortar, thus decreasing the water-to-gypsum ratio for the time during which the setting action is taking place. This water is later all evaporated from the wall.

Plasterers are entirely familiar with the need for various mix proportions to be used over various bases. This is one of the major advantages of job mixing over the use of mill mixed Perlite-gypsum plaster. On jobs where more than one type of base is to be plastered, job mixing in the proper proportions for each base assures better quality and in most cases effects an economy for the contractor.

Finish Coat Cracks

Fine cracks in lime putty finish coats which have no regular pattern and are usually much less than one foot apart, are sometimes called:

Map Cracks	Craze Cracks
Chip Cracks	Hairline Cracks
Check Cracks	Shrinkage Cracks

These are all caused by shrinkage in the finish coat. Structural cracks, on the other hand, usually are connected cracks in a steplike pattern of horizontal and vertical cracks, which often open and close with movement in the building.

Finish coat cracks may be caused by the use of insufficient gauging plaster, insufficient trowelling, basecoat surface too smooth, or basecoat surface too "sandy" or weak. They are practically never due to the quality of the materials used.

Good Bond Needed

Lime putty has no natural bond to the set gypsum - Perlite basecoat. The bond depends chiefly on a mechanical key or "tooth" and the strength of the white coat. All good plastering specifications state that "the surface of the brown coat shall be darbied and broomed to provide bond for the finish coat." This is a most important specification and failure to follow it is the direct cause of many finish coat cracks and failures. Most plasterers broom the surface of the brown coat, use a darby with a serrated edge, or in some other way develop a tooth or key for the white coat. Some of the newer generation of plasterers use water and a "slicker" to obtain a smooth glass-like surface on the brown coat. They reason that with a smooth brown coat surface, they will use less white coat material. This method will effect some saving in material; however, it is very poor practice and eventually results in cracks due to a separation between the finish and brown coat.

White coat shrinkage cracks are most commonly caused by insufficient use of gauging plaster and/or insufficient troweling. Specifications for smooth lime putty finish state that "it shall consist of three parts of lime putty to one part of dry gauging plaster by volume equivalent to two parts of dry hydrated lime to one part of gauging plaster by weight, and shall be thoroughly and uniformly mixed."

Plasterers often in a spirit of economy, switch from regular white gauging plaster to the use of unfibered neat plaster. This almost always results in check cracking. After the soaked lime putty is deposited on the mortar board, the plasterer makes a ring or trough in it with his trowel and measures out and pours into the ring enough water to soak up the amount of gauging he is accustomed to use. However, what many plasterers do not realize is that white gauging plaster will soak up only about half its weight in water, while most neat plaster will soak up about three-fourths of its weight in water. Thus, the plasterer has unknowingly used only two-thirds as much gypsum plaster as intended and the putty is undergauged. This will usually result in shrinkage cracks which the plasterer will stoutly maintain are the fault of the materials.

The gypsum gauging plaster in lime putty, when used in proper proportions, prevents checking or shinkage cracks, gives the finish coat initial strength and set and helps to bond it to the brown coat. It does not, however, improve the smooth working qualities or the spreadability of the lime putty. When a poor quality lime or one that has been improperly soaked results in a rubbery or "tough working" putty, plasterers are prone to reduce the proportion of gauging as a means of improving the plasticity. This is not good practice and often results in shrinkage cracks. This type of complaint seems to prevail during the cold winter and spring months when hydrated lime is most difficult to soak.

Hydrated lime will hold more than its own weight of water and it is necessary to trowel it heavily and repeatedly to squeeze out as much of this water as possible, to make the finish coat denser and harder and to insure a good mechanical key. If the putty coat is not well troweled, or if it is applied in too-thick a coat, shrinkage cracks will develop.

The suction characteristics of the basecoat play an important part in the application of the white coat. When the basecoat is wet or "green", small air blisters form under the trowel and are very difficult to work out. If the basecoat is too dry, the wall whitecoats "hot". This means that the water is immediately pulled out of the putty, greatly reducing its plasticity and making it difficult to obtain a smooth finish. When this occurs, some plasterers will wet down the wall to reduce the suction, which is a practical solution. A practice which is not recommended is the reduction of gauging plaster as a means of increasing plasticity and water retention in the putty. Naturally the problem is minimized by not letting the brown coat dry out completely before white coating.

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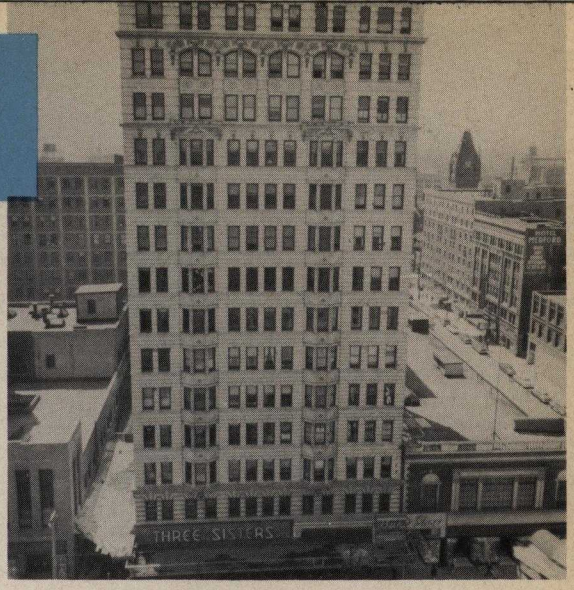
"Piped-In" Perlite Concrete Helps Save Sinking Building



Quick action and bold new construction methods with Perlite concrete have rescued Milwaukee's 14-story Majestic Building from sinking after its 900 wooden foundation pilings began to crumble late last year.

Today, as the result of experiments which showed that lightweight concrete can be successfully pumped to its placement, the 45-year-old commercial building stands firmly on steel columns encased in lightweight Perlite concrete.

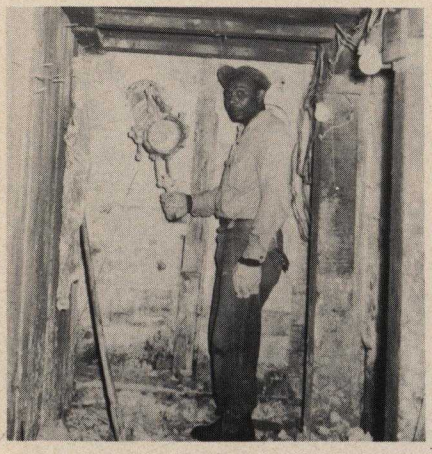
All work for this unusual transformation was carried out in a labyrinth of tunnels dug 25 feet beneath the building and opening into an unused theatre next door. Tenants of the building carried on business undisturbed while the entire foundation support was removed and replaced.

Preliminary examination had revealed that many of the building's 900 wooden foundation piles were decomposed by dry rot as the result of an 18 foot fall in the water table, which exposed the once-submerged piling to air in the silt and sand. To save the building, it was necessary to cut off the decayed ends of the piling and replace them with steel I beams wedged between the undamaged portion of the piling and the foundation.

In order to hold these beams in place, engineers of the Siesel Construction Co. decided to imbed them in lightweight concrete made with Perlite aggregate. Perlite concrete was selected because it was strong enough to keep the columns in place, inert so as to cause no electrolytic action with the steel, and lightweight so as to add a minimum of weight to the submerged wooden piling.

Biggest question facing the engineers was whether such a lightweight concrete could be pumped through the tunnels and compressed into forms surrounding the columns without excessive reduction in yield or segregation of the Perlite aggregate and cement. A second problem was whether the concrete could be pumped into the forms under sufficient pressure to pack them with a homogeneous mass from the silt and base to the concrete foundation above.

To answer these questions several pumping tests were made with a Chain Belt #160 Pump Crete machine. A mix of 1 sack of cement to 4.5 cu. ft. of Perlite proved to be satisfactory in producing a concrete with good troweling action and about a 4 in. slump.



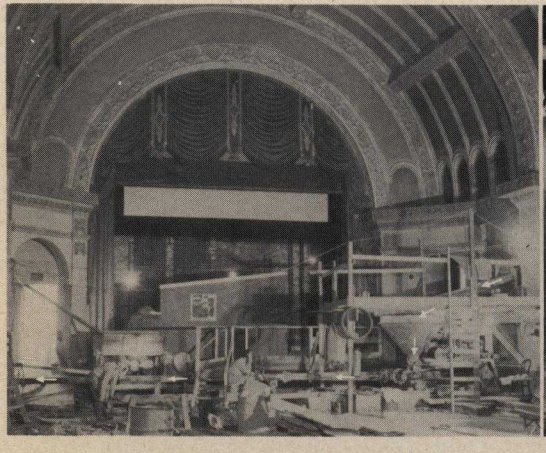
Partially stripped form. End of pipe line still set in Perlite concrete.

It was found that in order to pump Perlite concrete efficiently a Pump Crete machine in very good condition with minimum valve and liner clearance is required, since the fine nature of the Perlite aggregate permits it to run through small openings. *Machines which have already pumped a few thousand yards of heavyweight concrete may give unsatisfactory results with lightweight aggregate.*

Compressed air was used as a booster during pumping with one air connection near the pump, one at each point where it was necessary to pump down, and one about every 100 foot of horizontal pipe. A wet burlap "go-devil" was placed in the pipe before pumping was begun, and the Perlite concrete pushed it through ahead. This procedure kept the pipe full and reduced the possibility of air locks.

As soon as the form was full, the pump was disconnected and a rolled canvas "go-devil" inserted in the pipe line. An air connection was then made at the break and compressed air forced the "go-devil" and remaining concrete through the pipe. The form was thus packed under pressure, regulated not to exceed 5 psi. Too much pressure would have blown the forms apart.

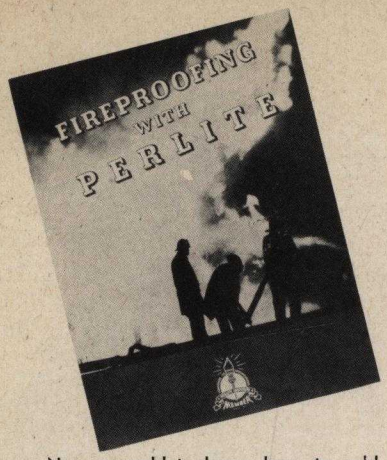
Tests made by the City of Milwaukee Testing Laboratory as the job progressed showed that the ready-mixed Perlite concrete retained satisfactory strength, density and yield even after pumping. When proper air entraining admix was used, the concrete had characteristics comparable to job mixed concrete conforming to specifications of the Perlite Institute.



Pump-Crete set up in theatre. Ready-mix concrete enters thru chute at right, is pumped to forms thru 6-in. pipe. Arrows show direction of flow.

Inspector checks steel columns before Perlite concrete is poured.
Photos: Milwaukee Star-Journal.

A.I.A. file No. 21A5 and 21C1



New pamphlet shows how to add safety and subtract weight in fireproof construction.

New Fireproofing Data Available

A new illustrated pamphlet describing 32 approved fire retardant building constructions using lightweight Perlite plaster and concrete is now available from members of the Perlite Institute or the Institute office.

The 8-page pamphlet, entitled "Fireproofing with Perlite," summarizes the results of fire tests run by Underwriters' Laboratories, Inc., the National Bureau of Standards and other recognized laboratories.

Fire retardant constructions which are described include thin, lightweight protections for steel columns, floors, ceilings and partitions.

Small diagrams showing the basic elements of each construction accompany the text.

Architects and builders will find the new pamphlet useful as a time-saving reference guide to approved fire retardant constructions designed to reduce dead load, conserve structural steel and provide more rentable floor space in new buildings. Once the appropriate construction has been selected, additional information and complete details for writing specifications and securing building code approvals can be secured from members of the Perlite Institute.

Perlite Concrete Chosen For Sub-Zero Warehouse — Continued

To gain maximum insulation value, a mix ratio of 8 cu ft of Perlite aggregate to 1 bag of cement and 2 pints of air entraining admix was used. This mixture produced a concrete weighing about 22 lb/cu ft with a compressive strength of 125 lb/sq ft. and a thermal conductivity "k" of 0.62. U factor of the floor was .062.

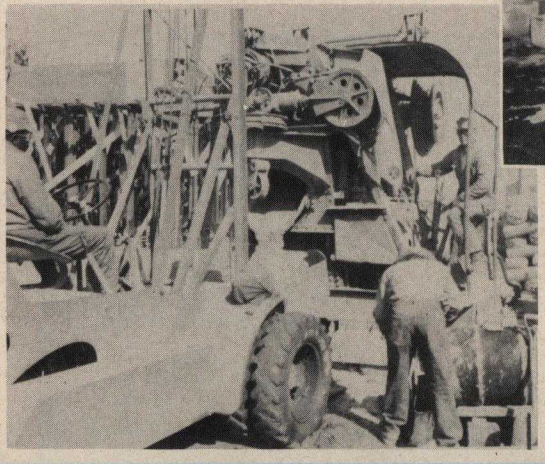
The same mix design was used for the 9-in. thickness of Perlite concrete roof insulation. This insulating layer was poured over a 10-in. structural concrete roof slab. Because of the non-spalling characteristic of Perlite concrete, it made an excellent base for the 10-year built-up roof of pitch, felt and gravel.

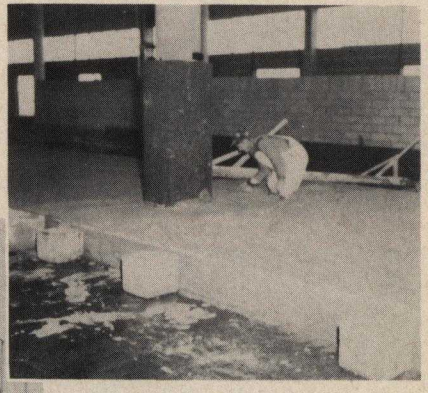
Job-mixed Perlite plaster was used throughout the main company offices, which occupy a two-story section 40 ft x 123 ft at the front of the building. Perlite aggregate was specified by the architects—A. Epstein and Son, Inc. of Chicago—not only for its lightness and workability, but because the insulating properties of Perlite plaster are expected to reduce the operating costs of heating and air conditioning the spacious offices.

Personnel in the offices are able to work with fewer distractions and greater efficiency as the result of a special mixture of Perlite acoustical plaster applied ½-in. thick on the ceilings. This Perlite acoustical coat was sprayed over gypsum lath in two ¼-in. layers, and provides a noise reduction coefficient of 0.60.

Construction of the giant freezer warehouse was begun by the Poirot Construction Co. in June, 1951, and half the plant went into operation in November of that year. Work on the remainder of the building continued through the winter despite cold weather. Here again Perlite aggregate saved hours of labor. Because the expanded aggregate is supplied in sealed bags, it could easily be delivered inside the building and so eliminated the need for thawing out frozen piles of loose sand or gravel.

Use of Perlite concrete in this huge refrigerated structure has demonstrated the effectiveness of Perlite insulation even under extreme temperature conditions. Continental Freezers' President Kenneth F. Stepleton, who has managed cold storage facilities for the past 20 years, said he is well satisfied with the excellent insulating properties of the poured floor and roof deck of Perlite concrete.





KNEE-DEEP IN PERLITE, workmen screed 12-in. thick insulating floor fill for –20°F storage rooms.

HUGE PAVER MIXERS mass produced Perlite concrete for 8 acres of floor and roof fill.